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Page 1 of: 50

Attention: **U.S.P.T.O.**
Examiner: Christopher P. GREY

From: Stephan P. Georgiev
Reg. No. 37,563

Application No.: **09/963,487**

Date: February 28, 2008

Reply to Montreal file no.: 86655-15

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CERTIFICATE OF TRANSMISSION BY FACSIMILE (37 CFR 1.8)			Docket No.
Applicant(s): Steve ROCHON et al.			86655-15
Application No.	Filing Date	Examiner	Group Art Unit
09/963,487	September 27, 2001	Christopher P. GREY	2616

Invention: METHOD AND SYSTEM FOR CONGESTION AVOIDANCE IN PACKET SWITCHING DEVICES

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P19/REV02

TRANSMITTAL LETTER (General - Patent Pending)	Docket No. 86655-15

In Re Application Of: Steve ROCHON et al.

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
09/963,487	September 27, 2001	Christopher P. GREY	28291	2616	8843

Title: METHOD AND SYSTEM FOR CONGESTION AVOIDANCE IN PACKET SWITCHING DEVICES

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Dated: February 28, 2008

Stephan P. Georgiev, Reg. No. 37,563
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In Re:	U.S. Patent Application of Steve ROCHON *et al.*		
App. No.:	09/963,487	Group Art Unit:	2616
Filed:	September 27, 2001	Examiner:	Christopher P. GREY
For:	**METHOD AND SYSTEM FOR CONGESTION AVOIDANCE IN PACKET SWITCHING DEVICES**		

REPLY BRIEF UNDER 37 CFR §41.41

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Further to the Examiner's Answer of December 28, 2007, submitted herewith is a Reply Brief in accordance with 37 CFR §41.41. This Reply Brief is being filed in order to address the Examiner's statements in the "Response to Arguments" section of the Examiner's Answer. As such, **the Examiner's attention is directed towards the new comments that commence on page 22 of this document**.

As per section 1208(I) of the MPEP, this Reply Brief includes all the requirements of a brief as set forth in 37 CFR §41.37(c).

If any fees are due, the Director is hereby authorized to debit the required amount from deposit account no. 19-2550 and to advise the Applicant accordingly.

I. Real Party in interest

The real party in interest is the assignee of the entire interest in the U.S. patent application, namely 4198638 Canada Inc.

II. Related Appeals and Interferences

The Applicant believes that there are no appeals or interferences that are related to, or may directly affect, or be affected by, or have a bearing on the Board's decision in the pending appeal.

III. Status of the Claims

The following is a statement of the current status of the claims that have been filed in the present application:

Claims 1-4, 25-37, 40-51, 53-55 and 57-58 are currently rejected.

Claims 5-24, 38 and 39 have been considered allowable by the Examiner.

Claims 52 and 56 are cancelled.

The text of claims 1-51, 53-55 and 57-58 can be seen in Section VIII entitled "Claims Appendix", included below.

The rejection of claims 1-4, 25-37, 40-51, 53-55 and 57-58 is being appealed.

IV. Status of Amendments

No amendments were filed in response to the final office action dated December 29, 2006. In addition, no amendments were filed subsequent to the filing of the response to the final office action.

The last amendments to the claims were made in the Applicant's communication to the Patent Office dated September 15, 2006, which was made in response to the non-final Office Action of May 17, 2006.

V. Summary of Claimed Subject Matter

The present application includes 56 claims, of which independent claims 1, 37, 40 and 46 are being appealed. A summary of independent claims 1, 37, 40 and 46 is provided below.

Claim 1

Claim 1 is directed to a method of regulating packet flow through a device (100). The device (100) has a processing fabric (102) with at least one input port (104) and at least one output port (106), a control entity (118) connected to the at least one input port (104) for regulating packet flow thereto, and a plurality of egress queues (112_{0-1}) connected to the at least one output port (106) for temporarily storing packets received therefrom [page 11, lines 12-14]. The method comprises obtaining bandwidth utilization information regarding packets received at the egress queues [page 13, lines 12-25], wherein obtaining the bandwidth utilization information includes determining the amount of bandwidth consumed by packets received at each of the egress queues (112_{0-1}) [page 17, lines 15-18, page 18, lines 5-10 and 21-25]. The method further comprises determining, from the bandwidth utilization information and the amount of bandwidth consumed by the packets received at each of the egress queues (112_{0-1}), a discard probability associated with each egress queue (112_{0-1}) [page 14, lines 7-11, page 24, line 20 to page 28, line 4]. The method further comprises providing the discard probability associated with each egress queue (112_{0-1}) to the control entity (118) [page 14, lines 19-25], for use by the control entity (118) in selectively transmitting packets to the at least one input port (106) of the processing fabric (102) [page 15, lines 4-7, page 32, lines 4-8].

Claim 37

Claim 37 is directed towards a drop probability evaluation module (120) for use in a device (100) having (i) a processing fabric (102) with at least one input port (104) and at least one output port (106); (ii) a control entity (118) connected to the at least one input port (104) for regulating packet flow thereto; and (iii) a plurality of egress queues (112_{0-1}) connected to the at least one output port (106) for temporarily storing packets received therefrom [page 11, lines 12-14]. The drop probability evaluation module (120) comprises means for obtaining bandwidth utilization information regarding packets received at the egress queues (112_{0-1}) [page 13, lines 12-25], wherein obtaining said bandwidth utilization information includes determining the amount of bandwidth consumed by packets received at each of said egress queues (112_{0-1}) [page 17, lines 15-18, page 18, lines 5-10 and 21-25]. The drop probability evaluation module (120) further comprises means for determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues (112_{0-1}), a discard probability associated with each egress queue (112_{0-1}) [page 14, lines 7-11, page 24, line 20 to page 28, line 4], and means for providing the discard probability associated with each egress queue (112_{0-1}) to the control entity (118) [page 14, lines 19-25], for use by the control entity (118) in selectively transmitting packets to the at least one input port (104) of the processing fabric (102) [page 15, lines 4-7, page 32, lines 4-8].

Claim 40

Claim 40 is directed towards an apparatus (100), comprising a processing fabric (102) having at least one input port (104) and at least one output port (106). The processing fabric (102) is adapted to process packets received from the at least one input port (104) and forward processed packets to the at least one output port (106). The apparatus (100) further comprises a plurality of egress queues (112_{0-1}), each connected to a corresponding one of the at least one output port

(106) of the processing fabric (102). Each egress queue (112_{0-1}) is adapted to (i) temporarily store packets received from the corresponding output port (106) of the processing fabric (102) [page 11, lines 12-14] and (ii) determine bandwidth utilization information on the basis of the packets received at the egress queues (112_{0-1}), by determining the amount of bandwidth consumed by packets received at each of the egress queues (112_{0-1}) [page 17, lines 15-18, page 18, lines 5-10 and 21-25]. The apparatus (100) further comprises a drop probability evaluation module (120) connected to the egress queues (112_{0-1}). The drop probability evaluation entity (120) is adapted to determine a discard probability associated with each of the egress queues (112_{0-1}) on the basis of the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of the egress queues (112_{0-1}) [page 14, lines 7-11, page 24, line 20 to page 28, line 4], and a packet acceptance unit (118) connected to the at least one input port (104) of the processing fabric (102) and to the drop probability evaluation module (120). The packet acceptance entity (118) is adapted to (i) receive packets destined for the at least one output port (106) of the processing fabric (102) [page 14, lines 20-23]; (ii) identify an egress queue (112_{0-1}) associated with each received packet [page 15, lines 1-4]; and (iii) on the basis of the discard probability associated with the egress queue (112_{0-1}) associated with each received packet, either transmit or not transmit said received packet to one of the at least one input port (104) of the processing fabric (102) [page 15, lines 4-7, page 16, lines 4-8].

Claim 46

Claim 46 is directed towards a method of regulating packet flow through a device (100) having an ingress entity (108), an egress entity (110), a processing fabric (102) between the ingress entity (108) and the egress entity (110), and a control entity (120) adapted to process packets prior to transmission thereof to the ingress entity (108). The method comprises obtaining congestion information regarding packets received at the egress entity (110) [page 13, lines 9-25], wherein obtaining said congestion information includes determining the amount

of bandwidth consumed by packets arriving at the egress entity queues (112_{0-1}) [page 13, lines 13-25, page 17, lines 15-18] and providing the congestion information to the control entity (120) [page 13, line 29 – page 14, line 3], for use by the control entity (120) in processing packets prior to transmission thereof to the ingress entity (108) [page 14, lines 19-29].

VI. Grounds of rejection to be reviewed on Appeal

A. In the final Office Action dated December 29, 2006, the Examiner has rejected claims 1-3, 25-27, 30, 36, 37, 40-51 and 57 under 35 U.S.C. §103(a) as being unpatentable over CA Patent 2,292,828 (hereafter to be referred to as Lyon) in view of U.S. Patent 7,002,980 (hereafter to be referred to as Brewer).

B. In the final Office Action dated December 29, 2006, the Examiner has rejected claims 4, 28, 29, 31-35, 54 and 55 under 35 U.S.C. §103(a) as being unpatentable over Lyon in view of Brewer in still further view of U.S. Patent Publication 2002/0105908 (hereafter to be referred to as Blumer).

C. In the final Office Action dated December 29, 2006, the Examiner has rejected claim 50 under 35 U.S.C 103(a) as being unpatentable over Lyon in view of Brewer in view of U.S. Patent 6,813,242 (hereafter to be referred to as Haskin et al.)

D. In the final Office Action dated December 29, 2006, the Examiner has rejected claim 58 under 35 U.S.C 103(a) as being unpatentable over Lyon in view of Brewer in still further view of U.S. Patent 6,728,253 (hereafter to be referred to as Jefferies et al.)

VII. Arguments

1. ARGUMENTS SUBMITTED IN APPEAL BRIEF OF AUG 29, 2007

A. *Response to Rejection of claims 1-3, 25-27, 30, 36, 37, 40-51 and 57 under 35 U.S.C. §103(a)*

As mentioned above in section (c)(1)(vii), the Examiner has rejected claims 1-3, 25-27, 30, 36, 37, 40-51 and 57 under 35 USC §103(a) as being unpatentable over CA Patent 2,292,828 (hereafter to be referred to as Lyon) in view of U.S. Patent 7,002,980 (hereafter to be referred to as Brewer).

For the reasons presented below, the Applicant respectfully disagrees with the Examiner's rejection, and submits that claims 1-3, 25-27, 30, 36, 37, 40-51 and 57, as they currently stand, are in allowable form.

Claims 1-3, 25-27. 30 and 36

The Examiner's attention is respectfully directed towards the following limitations of independent claim 1:

Claim 1
A method of regulating packet flow through a device having a processing fabric with at least one input port and at least one output port, a control entity connected to the at least one input port for regulating packet flow thereto, and a plurality of egress queues connected to the at least one output port for temporarily storing packets received therefrom, said method comprising:

obtaining bandwidth utilization information regarding packets received at the egress queues, **wherein obtaining said bandwidth utilization information includes determining the amount of bandwidth consumed by packets received at each of said egress queues;**

determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues, a discard probability associated with each egress queue; and

providing the discard probability associated with each egress queue to the control entity, for use by the control entity in selectively transmitting packets to the at least one input port of the processing fabric.

The Applicant respectfully submits that neither Lyon nor Brewer disclose, teach or suggest the above emphasized limitations of independent claim 1. More specifically, neither Lyon nor Brewer disclose "determining the amount of bandwidth consumed by packets received at each of said egress queues" and "determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues, a discard probability associated with each egress queue".

With respect to Lyon

Lyon does not disclose either of the above-emphasized limitations of independent claim 1.

Firstly, Lyon does not disclose the limitation of "wherein obtaining said bandwidth utilization information includes *determining the amount of bandwidth consumed by packets received at each of said egress queues*". Instead, and as has been previously set forth by the Applicant, Lyon measures the depth of egress queues (p.12, lines 16-17), which is merely a number of bits stored at the egress queues. This is completely different from the claimed limitation of determining the amount of bandwidth consumed by packets at the egress entity. It should be appreciated that the amount of bandwidth consumed by packets is a measure of *bits per second* (*i.e.* a rate of arrival). Given that Lyon simply measures the number of bits stored, and not the rate of bits being consumed, it is clear that Lyon does not disclose the above-emphasized feature of "determining the amount of bandwidth consumed by packets received at each of said egress queues".

The following non-limiting example has been provided in the past, and is again provided in order to illustrate the difference between the claimed invention and Lyon. Consider a router with 100 milliseconds of egress buffering (standard in the industry today), where traffic bursts at 10X the port capacity for 20 milliseconds and then drops to zero.

Time	Queue Depth (Lyon)	Bandwidth Consumed (present invention)
T=0	No congestion	100% of port capacity
T=1 millisecond	10% full (queue depth = low congestion)	1000% of port capacity (extreme congestion).
T= 10 milliseconds	90% full (queue depth = very high congestion	1000% of port capacity (extreme congestion).
T=11 milliseconds	100% full (queue depth = extreme congestion)	1000% of port capacity (extreme congestion)
T= 20 milliseconds	100% full (queue depth = extreme congestion)	Packets have stopped arriving 0% port capacity (no congestion)
T= 30 milliseconds	90% full (queue depth = very high congestion)	No packets arriving 0% port capacity (no congestion)

As demonstrated by the above example, the queue depth, which is what is being measured by Lyon, is completely different from a determination of the amount of bandwidth consumed. The queue depth, and the amount of bandwidth consumed are not interchangeable concepts. In light of this, the Applicant respectfully submits that the queue "congestion levels" as disclosed by Lyon do not read on "determining the amount of bandwidth consumed by packets arriving at the egress entity", as defined in independent claim 1.

Secondly, since Lyon does not determine the amount of bandwidth consumed by packets received at each egress queue, it is naturally impossible for Lyon to determine a discard probability based on such information. Thus, and not surprisingly, the Examiner concedes on page 2

of the final Office Action dated December 29, 2006 that Lyon does not disclose the above-emphasized feature of "determining from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each egress queue, a discard probability associated with each egress queue".

With respect to Brewer

The Applicant respectfully submits that Brewer does not disclose either of the above two limitations of independent claim 1 either. Instead, Brewer determines a time-weighed average byte count of a queue.

In the final Office Action dated December 29, 2006, the Examiner alleges that because Brewer determines a time-weighed average byte count of a queue, this can be considered as a unit of data per unit time. The Examiner thus argues that Brewer's time-weighted average byte count of a queue is equivalent to bandwidth, and thus teaches the limitation of "determining the amount of bandwidth consumed by packets received at each of said egress queues".

The Applicant respectfully disagrees with the Examiner's position, and submits that equating the time-weighted average byte count of a queue to the bandwidth being consumed by packets received at the queue is incorrect. Specifically, the amount of bandwidth being consumed is a dynamic quantity that is a measure of data per unit time. However, time-weighting the depth of a queue over time, as is done in Brewer, does <u>not</u> yield the same result. Quite simply, because a queue can be filled and emptied at independent rates, its time-average depth bears no relation to the <u>rate</u> at which it is being emptied (or filled). In fact, the measurement unit of a time-weighted queue depth is a number of **<u>bytes</u>**, while the measurement unit of bandwidth is a number of **<u>bytes per unit time</u>**.

To be precise, Brewer's quantity is a sum of a plurality of quantities of bytes with each such quantity of bytes being attributed a weight in the form of a percentage or fraction (with the weights of all the quantities of bytes generally adding up to 100%). Thus, a time-weighted average byte count is an average of byte counts, with certain of the byte-count values factored into the average being given greater importance than others. Nevertheless, it remains an average of byte counts, which necessarily implies that it has a measurement unit of bytes (data), not data per unit time (data rate). The two quantities are not interchangeable.

For the Examiner's further consideration, the Applicant provides the following detailed but absolutely non-limiting illustration, which is an example provided in above with respect to Lyon, but is now further detailed to account for Brewer. Specifically, consider a router with 100 milliseconds of egress buffering (standard in the industry today), where traffic bursts at 10 times the port capacity (*i.e.*, 1000%) for 20 milliseconds and then drops to zero.

Time (ms)	Description	Lyon/Brewer (queue depth, in % occupancy)	Invention (bandwidth, in % port capacity)
0	The queues are empty. Since there has been no queue depth so far, Lyon's queue depth is zero and Brewer's time-weighted average is also zero. However, the bandwidth consumed by packets received is 1000% of the port capacity.	0%	1000%
1	The queues are still only 10% full (low queue depth appears to signal low congestion). Brewer's time-weighted average will average 0% and 10%, giving more weight to 10% because it is more recent. This will produce a number between 5% and 10% (even lower than the instantaneous depth). The bandwidth consumed by packets received is still 1000%.	Between 5% and 10%	1000%
10	The queues are 90% full. Brewer's time-weighted average here will have to be somewhere below 90% because it	under 90%	1000%

	factors in older values of queue depth and the queue has only been increasing. The bandwidth consumed by packets received is still 1000%.		
11	The queues are 100% full. Brewer's time-weighted average will be nearing 100%, its value depending on the weight given to older values of queue depth. Packets are still consuming 1000% of the bandwidth.	Nearing 100%	1000%
20	The queues are 100% full. Brewer's time-weighted average will probably be 100% or a bit less (depending on how older data is weighted) but packets have stopped arriving. As such, the bandwidth consumed by packets received is 0%.	Nearing 100%	0%
30	The queues are down to 90% full. Brewer's time-weighted average will be even higher than 90% because it averages in the recent (higher) depth values. However, no packets are arriving so the bandwidth consumed by packets received is still 0%.	Above 90%	0%

As demonstrated by the above example, determining a time-weighted average byte count, which is what is being measured by Brewer, is completely different from determining the amount of bandwidth consumed by received packets. The time-weighted average byte count, and the amount of bandwidth consumed by received packets are thus **not** equivalent or interchangeable concepts/quantities. In light of this observation, the Applicant respectfully submits that Brewer's determination of the time-weighted average for the actual byte count for a particular queue does not teach or suggest "determining the amount of bandwidth consumed by packets arriving at the egress entity", and neither does it teach or suggest "determining from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each egress queue, a discard probability associated with each egress queue", both of which are recited in independent claim 1 and which, it will be recalled, have been shown to be absent from Lyon as well.

As per § 2143.03 of the *Manual of Patent Examining Procedure*, in order to establish a *prima facie* case of obviousness, the combined prior art references must teach or suggest all of the claim limitations. Since it has been shown that neither Lyon nor Brewer teach or suggest the above limitations of independent claim 1, the Applicant respectfully submits that the combination of these references is not sufficient for establishing a *prima facie* case of obviousness as per § 2143.03 of the MPEP. Accordingly, the Examiner is respectfully requested to withdraw the rejection to independent claim 1.

Claims 2-3, 25-27. 30 and 36 depend from independent claim 1, and thus incorporate by reference all the limitations contained therein. Accordingly, for the same reasons as those presented above with respect to independent claim 1, the Applicant respectfully submits that the combination of references cited by the Examiner is insufficient for establishing a *prima facie* case of obviousness as per § 2143.03 of the MPEP for dependent claims 2-3, 25-27. 30 and 36. The Examiner is thus respectfully requested to withdraw the rejection to dependent claims 2-3, 25-27. 30 and 36.

Claim 37

The Examiner's attention is respectfully directed towards the following limitations of independent claim 37:

A drop probability evaluation module for use in a device having (i) a processing fabric with at least one input port and at least one output port; (ii) a control entity connected to the at least one input port for regulating packet flow thereto; and (iii) a plurality of egress queues connected to the at least one output port for temporarily storing packets received therefrom, said drop probability evaluation module comprising:

means for obtaining bandwidth utilization information regarding packets received at the egress queues, **wherein obtaining said bandwidth utilization information includes determining the amount of bandwidth consumed by packets received at each of said egress queues**;

means for **determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues, a discard probability associated with each egress queue**; and

means for providing the discard probability associated with each egress queue to the control entity, for use by the control entity in selectively transmitting packets to the at least one input port of the processing fabric.

The Applicant respectfully submits that neither Lyon nor Brewer disclose, teach or suggest the above-emphasized limitations of independent claim 37. The language of claim 37 is similar to that of independent claim 1, and as such, for the same reasons as those presented above with respect to independent claim 1, the Applicant respectfully submits that the prior art cited by the Examiner is insufficient to establish a *prima facie* case of obviousness against independent claim 37.

Claim 40

The Examiner's attention is respectfully directed towards the following limitations of independent claim 40:

An apparatus, comprising:

a processing fabric having at least one input port and at least one output port, the processing fabric being adapted to process packets received from the at least one input port and forward processed packets to the at least one output port;

a plurality of egress queues, each connected to a corresponding one of the at least one output port of the processing fabric, each egress queue being adapted to (i) temporarily store packets received from the corresponding output port of the processing fabric and (ii) **determine bandwidth utilization information on the basis of the packets received at the egress queues, by *determining the amount of bandwidth consumed by packets received at each of said egress queues***;

a drop probability evaluation module connected to the egress queues, said drop probability evaluation entity being adapted to **determine a discard probability associated with each of the egress queues *on the basis of the bandwidth utilization information* and the amount of bandwidth consumed by packets received at each of said egress queues**; and

a packet acceptance unit connected to the at least one input port of the processing fabric and to the drop probability evaluation module, the packet acceptance entity being adapted to (i) receive packets destined for the at least one output port of the processing fabric; (ii) identify an egress queue associated with each received packet; and (iii) on the basis of the discard probability associated with the egress queue associated with each received packet, either transmit or not transmit said received packet to one of the at least one input port of the processing fabric.

The Applicant respectfully submits that neither Lyon nor Brewer disclose, teach or suggest the above-emphasized limitations of independent claim

40. The language of claim 40 is similar to that of independent claim 1, and as such, for the same reasons as those presented above with respect to independent claim 1, the Applicant respectfully submits that the prior art cited by the Examiner is insufficient to establish a *prima facie* case of obviousness against independent claim 40.

Claims 41-45 depend from independent claim 40, and thus incorporate by reference all the limitations contained therein. Accordingly, for the same reasons as those presented above with respect to independent claim 40, the Applicant respectfully submits that the combination of references cited by the Examiner is insufficient for establishing a *prima facie* case of obviousness as per § 2143.03 of the MPEP for dependent claims 41-45. The Examiner is respectfully requested to withdraw the rejection to dependent claims 41-45.

Claim 46

The Examiner's attention is respectfully directed towards the following limitations of independent claim 46:

> A method of regulating packet flow through a device having an ingress entity, an egress entity, a processing fabric between the ingress entity and the egress entity, and a control entity adapted to process packets prior to transmission thereof to the ingress entity, said method comprising:
>
> obtaining congestion information regarding packets received at the egress entity, **wherein obtaining said congestion information includes determining the amount of bandwidth consumed by packets arriving at the egress entity**; and
>
> providing the congestion information to the control entity, for use by the control entity in processing packets prior to transmission thereof to the ingress entity.

The Applicant respectfully submits that neither Lyon nor Brewer disclose, teach or suggest the above-emphasized limitation of independent claim 46.

More specifically, as indicated above with respect to independent claim 1, and as has been conceded by the Examiner on page 2 of the final office action, the step of "determining the amount of bandwidth consumed by

packets arriving at the egress entity" is not disclosed by Lyon. In addition, this step is also absent from Brewer. As has previously been set forth, determining a time-weighted average byte count, which is what is being measured by Brewer, *is completely different from determining the amount of bandwidth consumed by arriving packets*. The time-weighted average byte count, and the amount of bandwidth consumed by arriving packets are thus **not** equivalent or interchangeable concepts/quantities. In light of this observation, the Applicant respectfully submits that Brewer's determination of the time-weighted average for the actual byte count for a particular queue does not teach or suggest the above-emphasized limitation of independent claim 46.

As such, the Applicant respectfully submits that the combination of Lyon and Brewer is insufficient for establishing a *prima facie* case of obviousness as per §2143.03 of the MPEP. Accordingly, the Examiner is respectfully requested to withdraw the rejection of independent claim 46.

Claims 47-51 and 57 depend from independent claim 46, and thus incorporate by reference all the limitations contained therein. Accordingly, for the same reasons as those presented above with respect to independent claim 46, the Applicant respectfully submits that the combination of references cited by the Examiner is insufficient for establishing a *prima facie* case of obviousness as per § 2143.03 of the MPEP against dependent claims 47-51 and 57. The Examiner is respectfully requested to withdraw the rejection to dependent claims 47-51 and 57.

B. Response to Rejection of claims 4, 28, 29, 31-35, 54 and 55 under 35 U.S.C. §103(a)

As mentioned above in section (c)(1)(vii), the Examiner has rejected claims 4, 28, 29, 31-35, 54 and 55 under 35 USC §103(a) as being unpatentable

over Lyon in view of Brewer in still further view of U.S. Patent Publication 2002/0105908 (hereafter to be referred to as Blumer).

For the reasons presented below, the Applicant respectfully disagrees with the Examiner's rejection, and submits that rejected claims 4, 28, 29, 31-35, 54 and 55, as they currently stand, are in allowable form.

Claims 4, 28, 29 and 31-35

Claims 4, 28, 29 and 31-35 depend from independent claim 1 and as such incorporate by reference all the limitations contained therein, including the following limitations which have already been shown to be absent from both Lyon and Brewer:

> obtaining bandwidth utilization information regarding packets received at the egress queues, **wherein obtaining said bandwidth utilization information includes determining the amount of bandwidth consumed by packets received at each of said egress queues;**
>
> **determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues, a discard probability associated with each egress queue;**

It is further submitted that the above limitations are also absent from Blumer. Blumer merely discloses a mechanism for determining a drop probability for a buffer using a number of variables. The Examiner has previously, in the Office Action of May 17th, 2006, pointed to paragraph [0029] of Blumer for a description of the variables used. Having reviewed paragraph [0029], the Applicant respectfully submits that the amount of bandwidth consumed by received packets is not one of the variables. As such, Blumer cannot possibly disclose "determining, from the bandwidth utilization information <u>and the amount of bandwidth consumed by packets received at each of said egress queues</u>, a discard probability associated with each egress queue"[emphasis added].

In summary, neither Blumer nor Lyon or Brewer teach or suggest the feature of "wherein obtaining said bandwidth utilization information includes determining the *amount of bandwidth* consumed by packets received at each of said egress queues" or the feature of "determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues, a discard probability associated with each egress queue".

Given that none of the three references cited by the Examiner teach the above two limitations of claims 4, 28, 29 and 31-35, the Applicant respectfully submits that the combination of these references is not sufficient for establishing a *prima facie* case of obviousness as per § 2143.03 of the MPEP. Accordingly, the Examiner is respectfully requested to withdraw his rejection to dependent claims 4, 28, 29 and 31-35.

Claims 54 and 55

Claims 54 and 55 depend from independent claim 46 and as such incorporate by reference all the limitations contained therein, including the following limitation which has already been shown to be absent from both Lyon and Brewer.

> obtaining congestion information regarding packets received at the egress entity, **said congestion information including information associated with the amount of bandwidth consumed by packets arriving at the egress entity; and**

It is further submitted that the above feature is also absent from Blumer, which as described above, merely teaches a refinement to calculating a drop probability based on queue depth (a quantity of bits stored) *not* the amount of bandwidth consumed by packets arriving at the egress entity. Blumer lists in paragraph [0029] a number of other factors that can be taken into account when determining drop probability, but the amount of bandwidth consumed is not in the list. As such, the Applicant respectfully

submits that Blumer does not teach or suggest the above emphasized limitation of independent claim 46.

Accordingly, since none of the references cited by the Examiner teach or suggest the above feature of independent claim 46, and since claims 54 and 55 depend from independent claim 46, the Applicant respectfully submits that the references cited by the Examiner do not support a *prima facie* case of obviousness, as per § 2143.03 of the MPEP. Accordingly, the Examiner is respectfully requested to withdraw the rejection of claims 54 and 55.

C. Response to Rejection of claim 50 under 35 U.S.C. §103(a)

As mentioned above in section (c)(1)(vii), the Examiner has rejected claim 50 under 35 USC §103(a) as being unpatentable over Lyon in view of Brewer in further view of U.S. Patent 6,813,242 (hereafter to be referred to as Haskin et al.)

For the reasons presented below, the Applicant respectfully disagrees with the Examiner's rejection, and submits that claim 50, as it currently stands, is in allowable form.

Claim 50

Claim 50 depends from independent claim 46 and as such incorporates by reference all the features contained therein, including the following limitation which has already been shown to be absent from both Lyon and Brewer:

obtaining said congestion information includes determining the amount of bandwidth consumed by packets arriving at the egress entity

The Applicant further submits that this feature is also absent from Haskin. As can be seen in Figure 3 of Haskin, and the accompanying description in

column 4, lines 51-62, Haskin teaches monitoring for the presence of traffic coming into a switch from an external link, and using that information to infer either congestion or a failed link, and then reroute traffic. Nowhere does Haskin disclose congestion information that includes "determining the amount of bandwidth consumed by packets arriving at the *egress* entity".

Accordingly, since none of the references cited by the Examiner teaches the above feature of independent claim 46, and since claim 50 depends from independent claim 46, the Applicant respectfully submits that the references cited by the Examiner do not support a *prima facie* case of obviousness, as per § 2143.03 of the MPEP. Accordingly, the Examiner is respectfully requested to withdraw the rejection of claim 50.

D. Response to Rejection of claim 58 under 35 U.S.C. §103(a)

As mentioned above in section (c)(1)(vii), the Examiner has rejected claim 50 under 35 USC §103(a) as being unpatentable over Lyon in view of Brewer in further view of U.S. Patent 6,728,253 (hereafter to be referred to as Jefferies et al.)

For the reasons presented below, the Applicant respectfully disagrees with the Examiner's rejection, and submits that claim 58, as it currently stands, is in allowable form.

Claim 58 depends from independent claim 46 and as such incorporates by reference all the features contained therein, including the following limitation which has already been shown to be absent from both Lyon and Brewer:

obtaining said congestion information includes determining the amount of bandwidth consumed by packets arriving at the egress entity

The Applicant further submits that this limitation is also absent from Jefferies et al. As can be seen in col. 2, lines 25-44 of Jefferies et al., this reference relates to using queue occupancy (buffer depth again) to selectively pause and re-enable transmission to a set of queues. Nowhere does Jefferies disclose congestion information that includes "determining the amount of bandwidth consumed by packets arriving at the *egress* entity".

Accordingly, since none of the references cited by the Examiner teach the above limitation of independent claim 46, and since claim 58 depends from this claim, the Applicant respectfully submits that the references cited by the Examiner do not support a *prima facie* case of obviousness, as per § 2143.03 of the MPEP. Accordingly, the Examiner is respectfully requested to withdraw the rejection to dependent claim 58.

2. ***ARGUMENTS SUBMITTED IN RESPONSE TO THE EXAMINER'S "RESPONSE TO ARGUMENT" SECTION IN THE EXAMINER'S RESPONSE DATED DECEMBER 28, 2007***

In paragraph (b), on page 19 of the Examiner's Answer, the Examiner contends that "The appellant argues that Brewer's average byte count which is a measure of the data per unit time in a queue is not equivalent to the amount of bandwidth consumed because the measurement unit of bandwidth is a number of bytes per unit time".

The Applicant respectfully submits that the Examiner's statement is incorrect. More specifically, what the Applicant is arguing is that Brewer's average byte count **is *NOT a measure of data per unit time***.

The Examiner goes on to indicate that "In response to appellant's argument that the reference fails to show the measurement unit of bandwidth being a number of bytes per unit time, it is noted that the features upon which

appellant relies are not recited in the rejected claims...Nowhere within the claim does the appellant claim the amount of data per unit of time. ".

In response, the Applicant respectfully submits that the rejected claims refer to "obtaining bandwidth utilization information" that "includes determining the amount of bandwidth consumed by packets received at each of said egress queues". Therefore, with respect to the Examiner's comment that nowhere in the claims do we claim the amount of data per unit time, the Applicant respectfully submits the following:

- First, "bandwidth" as used in the field of routers, and data transmission in general, is well understood to mean data per unit time.
- Second, the Examiner himself has repeatedly interpreted "bandwidth" in this way, including in alleging that a time-weighted average of a byte count is equivalent to bandwidth because it (allegedly) has units of bytes per unit time.

As the Applicant has stated numerous times, Brewer's *time-weighted average of the count of bytes in a queue* is not the same as bandwidth at *all*. We have shown by irrefutable examples that the two are not equivalent, and that in many cases substituting one for the other does not produce even remotely similar results. Brewer does not disclose anything about bandwidth. As such, the Applicant respectfully re-iterates that this reference neither anticipates nor renders obvious the claimed subject matter of the present application.

The Examiner alleges on page 18 of the Examiner's response, that "Brewer specifically discloses determining...an average byte count (col 8, eq 3.1 equivalent to a bandwidth consumed by packets at an egress queue)". But this is factually just wrong. The units of a time weighted average of a number of bytes (which is what is disclosed by Brewer) is not the same as

the unit of bandwidth (which the Examiner agrees is byte per unit time). The units of a time weighted average of a number of bytes is simply a number of bytes. It is NOT a number of bytes per unit time!

To take a simple average, one adds N values and then divides the total by N. The result always has the same units as the values themselves, because N is a pure (unit-less) number. To take a weighted average, one adds up w1*Value1 + w2*value2,...+ wN*ValueN, and then divides by w1+w2...+wN, where w1-wN are the weights given to the respective measurements. All the weights have the same units, so all the wX*valueX elements being summed have the units of the weight as well as the units of the value, and the sum of the weights has the same units as the individual weights. When the total of the weighted valued is divided by the sum of the weights, the units of the weights cancel, and one is left with the same units as the values.

To see this, consider just the units. If each value has units of Uv and each weight has units of Uw, then each weighted value has units of Uv*Uw so the sum of the weighted values has units of Uv*Uw. The divisor in the weighted average is the sum of the weights, and since each weight has units of Uw, their sum has units of Uw. The units of the weighted average are thus Uv*Uw/Uw, or Uv.

Thus a weighted average has the same units as the values being averaged!

There are at least two ways to calculate a time-weighted average:

1. In one, the time relative to a reference time determines the weight (e.g. the most recent measurement is given the highest weight, while older measurements are given less weight). The weight is a pure (unit-less) number, and so no units Uw exist to show up in the Units equation.

2. In the second, each value is weighted by the amount of time for which the value was the measured value. Each weight thus contains the unit *time*, and the sum of these weights thus also contains the unit *time*. In dividing the sum of the weighted values by the sum of the weights, these units of *time* cancel; thus the units of the time-weighted average of the values has the same units as the values.

In either case, as with **any** average, **the average of the values has the same units as the values being averaged**. As such, neither an average byte count nor a time weighted average of the byte count, are the same as an amount of bytes per unit time. Given that the claims refer to obtaining a bandwidth, which is known to mean bytes per unit time, the Applicant respectfully submits that the claimed limitations are not anticipated nor rendered obvious by the references cited by the Examiner.

In his final argument, the Examiner indicates that "the bandwidth within a queue is equivalent to the capacity of data in that queue" and that "In the case of Brewer, the Appellant admits to Brewer showing a queue depth being a number of bytes, where that number of bytes is equivalent to the capacity or bandwidth of that queue". The Applicant respectfully disagrees with both of the Examiner's statements.

Firstly, the Examiner claims that the bandwidth is equivalent to capacity, even though the Examiner has elsewhere acknowledged that bandwidth has units of bytes per second and capacity has units of bytes. As such, this statement does not seem to make sense. Secondly, the Examiner alleges that the Applicant *admits* to this alleged equivalence! The Applicant respectfully submits that the Examiner is mistaken, and that the Applicant admits no such thing. While the Applicant admits that Brewer shows a queue depth being a number of bytes, <u>we very clearly and repeatedly state,</u>

and demonstrate with examples, that this is **NOT** the equivalent of bandwidth!

The following is yet a further example of how bandwidth and capacity of data re NOT equivalent. Assume an individual gets a flat tire at mile 300 on the highway, so the individual stops and calls a tow truck. The individual tells the tow truck that he/she is stopped at mile 300. An hour goes by and the tow truck hasn't arrived, so the individual pushes the car further to the side of the road. This moves the car 15 feet forward, so that the individual is now at mile 300.003. The tow truck finally shows up two hours later.

Therefore, the position of 300.003 is a mile count (the count of miles from the start of the highway). Take a time-weighted average of that position. The individual spent 1 hour at mile 300, so that value has a weight of 1 hour, and 2 hours at mile 300.003, so that value has a weight of 2 hours. The time weighted average is ((1 hour * mile 300) + (2 hours * mile 300.003))/(1 hour + 2 hours). This (900.006 mile*hours) / (3 hours). The hours cancel, leaving the time-weighted average position as mile 300.002. This time-weighted average is indeed still a count of miles. It is not, as the Examiner contends, equivalent to 300.002 miles per hour. The individual is not traveling at 300 miles per hour!

Thus it is clear that the Examiner is mistaken about the equivalence of a time-weighted average and a bandwidth; the time-weighted average of a count is a count, and not a count per unit time. Simply substitute a byte count for a mile count in the above example. The time-weighted average is still a count of bytes, and not, as the Examiner contends, a number of bytes per unit time.

Brewster himself states, in the very passage to which the Examiner refers (Column 8, lines 50-52), "**The average byte count is calculated by determining the time-weighted average for the actual byte count for**

that particular queue". Thus Brewster himself uses units of byte count for the time-weighted average of a byte count.

Thus usage of units in the very passage of Brewster to which the Examiner refers is consistent with the Applicant's argument, and is not consistent with the Examiner's rejection.

VIII. Claim Appendix

The following is a listing of the claims involved in the present appeal.

1. (Previously presented) A method of regulating packet flow through a device having a processing fabric with at least one input port and at least one output port, a control entity connected to the at least one input port for regulating packet flow thereto, and a plurality of egress queues connected to the at least one output port for temporarily storing packets received therefrom, said method comprising:

   obtaining bandwidth utilization information regarding packets received at the egress queues, wherein obtaining said bandwidth utilization information includes determining the amount of bandwidth consumed by packets received at each of said egress queues;

   determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues, a discard probability associated with each egress queue; and

   providing the discard probability associated with each egress queue to the control entity, for use by the control entity in selectively transmitting packets to the at least one input port of the processing fabric.

2. (Original) A method as defined in claim 1, wherein obtaining bandwidth utilization information regarding packets received at the egress queues includes receiving said bandwidth utilization from at least one traffic management entity located between the egress queues and the at least one output port.

3. (Original) A method as claimed in claim 1, wherein each packet is made up of either a plurality of traffic bytes or a plurality of non-traffic bytes, and wherein obtaining bandwidth utilization information regarding packets

received at the egress queues further includes determining, for each particular one of the at least one output port, an average number of traffic bytes received per time unit for each egress queue connected to the particular output port.

4. (Original) A method as claimed in claim 3, wherein determining, from the bandwidth utilization information, a discard probability for a particular one of the egress queues includes:

determining an allocated traffic bandwidth for the particular egress queue;

comparing the average number of received traffic bytes for the particular egress queue to the allocated traffic bandwidth for the particular egress queue; and

if the average number of received traffic bytes for the particular egress queue is greater than the allocated traffic bandwidth for the particular egress queue, increasing the discard probability for the particular egress queue;

if the average number of received traffic bytes for the particular egress queue is less than the allocated traffic bandwidth for the particular egress queue, decreasing the discard probability for the particular egress queue.

5. (Original) A method as claimed in claim 3, wherein determining, from the bandwidth utilization information, a discard probability for a particular one of the egress queues includes:

determining an allocated traffic bandwidth for the particular egress queue;

comparing the average number of received traffic bytes for the particular egress queue to the allocated traffic bandwidth for the particular egress queue; and

if the average number of received traffic bytes for the particular egress queue is greater than the allocated traffic bandwidth for the particular

egress queue, setting the discard probability for the particular egress queue to the sum of a time average of previous values of the discard probability for the particular egress queue and a positive increment;

if the average number of received traffic bytes for the particular egress queue is less than the allocated traffic bandwidth for the particular egress queue, setting the discard probability for the particular egress queue to the sum of said time average of previous values of the discard probability for the particular egress queue and a negative increment.

6. (Original) A method as claimed in claim 3, wherein determining a discard probability for a particular egress queue includes:

(a) setting a temporary average number of received traffic bytes to the average number of received traffic bytes;

(b) setting a temporary discard probability equal to a time average of previous values of the discard probability for the particular egress queue;

(c) determining an allocated traffic bandwidth for the particular egress queue;

(d) comparing the temporary average number of received traffic bytes to the allocated traffic bandwidth for the particular egress queue;

(e) if the temporary average number of received traffic bytes is greater than the allocated traffic bandwidth for the particular egress queue, adding to the temporary discard probability a positive probability increment and adding to the temporary average number of received traffic bytes a negative bandwidth increment;

(f) if the temporary average number of received traffic bytes is less than the allocated traffic bandwidth for the particular egress queue, adding to the temporary discard probability a negative probability increment and adding to the temporary average number of received traffic bytes a positive bandwidth increment; and

(g) setting the discard probability for the particular egress queue to the temporary discard probability.

7. (Original) A method as defined in claim 6, further including performing steps (d), (e) and (f) a pre-determined number of times.

8. (Original) A method as defined in claim 6, further including performing steps (d), (e) and (f) until the temporary average number of received traffic bytes is within a desired range of the allocated traffic bandwidth for the particular egress queue.

9. (Original) A method as defined in claim 8, further including measuring a depth of the particular egress queue and performing steps (d), (e) and (f) until the depth of the particular egress queue is within a desired range.

10. (Original) A method as defined in claim 9, further including measuring a variability of the depth of the particular egress queue and performing steps (d), (e) and (f) until the variability of the depth of the particular egress queue is within a desired range.

11. (Original) A method as defined in claim 6, further including performing steps (d), (e) and (f) until the temporary discard probability for the particular egress queue converges to a desired precision.

12. (Original) A method as claimed in claim 6, wherein determining an allocated traffic bandwidth for the particular egress queue includes:

determining an average number of traffic bytes that would be received at the particular egress queue if the discard probability for the particular egress queue were zero; and

if the average number of traffic bytes that would be received at the particular egress queue if the discard probability for the particular egress queue were zero is greater than the allocated traffic bandwidth for the

particular queue, adding a positive increment to the allocated traffic bandwidth for the particular egress queue;

if the average number of traffic bytes that would be received at the particular egress queue if the discard probability for the particular egress queue were zero is less than the allocated traffic bandwidth for the particular queue, adding a negative increment to the allocated traffic bandwidth for the particular egress queue.

13. (Original) A method as claimed in claim 6, further comprising:

determining an available traffic bandwidth for all egress queues connected to the particular output port; and

determining a total traffic bandwidth allocated for all egress queues connected to the particular output port;

wherein the step of adding a positive increment to the allocated traffic bandwidth for the particular egress queue is executed only if the total traffic bandwidth allocated for all egress queues connected to the particular output port is less than the available traffic bandwidth for all egress queues connected to the particular output port.

14. (Original) A method as claimed in claim 13, wherein determining an available traffic bandwidth for all egress queues connected to the particular output port includes:

determining a bandwidth gradient that is indicative of a rate at which the available traffic bandwidth for all egress queues connected to the particular output port is to be increased or decreased;

increasing or decreasing the available traffic bandwidth for all egress queues connected to the particular output port as a function of the bandwidth gradient.

15. (Original) A method as claimed in claim 14, wherein obtaining bandwidth utilization information regarding packets received at the egress queues

further includes determining, for each particular one of the at least one output port, an average number of non-traffic bytes received per time unit from the particular output port, and wherein determining an available traffic bandwidth for all egress queues connected to the particular output port further includes:

determining a total link capacity available for all the egress queues connected to the particular output port;

setting a maximum available traffic bandwidth to the difference between said total link capacity and said average number of non-traffic bytes;

wherein the available traffic bandwidth for all egress queues connected to the particular output port is bounded above by the maximum available traffic bandwidth.

16. (Original) A method as claimed in claim 15, wherein determining the average number of traffic bytes that would be received at the particular egress queue if the discard probability for the particular egress queue were zero includes evaluating a function of the average number of traffic bytes received per time unit for the particular egress queue and the time average of previous values of the discard probability for the particular egress queue.

17. (Original) A method as claimed in claim 16, wherein the function is the quotient between (i) the average number of traffic bytes received per time unit for the particular egress queue and (ii) the difference between unity and the time average of previous values of the discard probability for the particular egress queue.

18. (Original) A method as claimed in claim 6, further comprising:

determining an average number of traffic bytes that would be received at the particular egress queue if the discard probability for the particular egress queue were zero; and

performing steps (d), (e) and (f) at least twice;

wherein the positive bandwidth increment is a first fraction of average number of traffic bytes that would be received at the particular egress queue if the discard probability for the particular egress queue were zero, said first fraction decreasing with subsequent executions of step (f); and

wherein the negative bandwidth increment is a second fraction of average number of traffic bytes that would be received at the particular egress queue if the discard probability for the particular egress queue were zero, said second fraction decreasing with subsequent executions of step (e).

19. (Original) A method as claimed in claim 18, wherein the positive probability increment has a value that decreases with subsequent executions of step (e) and wherein the negative probability increment has a value that decreases with subsequent executions of step (f).

20. (Original) A method as defined in claim 14, wherein obtaining bandwidth utilization information regarding packets received at the egress queues includes determining, for each particular one of the at least one output port, an average idle time between successive packets received from the particular output port.

21. (Original) A method as claimed in claim 20, wherein determining a bandwidth gradient includes:

comparing the average idle time between successive packets received from the particular output port to a first threshold; and

if the average idle time between successive packets received from the particular output port is below the first threshold, setting the bandwidth gradient to indicate a first rate of decrease in the available traffic bandwidth for all egress queues connected to the particular output port.

22. (Original) A method as claimed in claim 21, further comprising:

comparing the average idle time between successive packets received from the particular output port to a second threshold less than the first threshold; and

if the average idle time between successive packets received from the particular output port is below the second threshold, setting the bandwidth gradient to indicate a second rate of decrease in the available traffic bandwidth for all egress queues connected to the particular output port, wherein said second rate of decrease is greater than said first rate of decrease.

23. (Original) A method as claimed in claim 22, further comprising:

comparing the average idle time between successive packets received from the particular output port to a third threshold; and

if the average idle time between successive packets received from the particular output port is above the third threshold, setting the bandwidth gradient to indicate a rate of increase in the available traffic bandwidth for all egress queues connected to the particular output port.

24. (Original) A method as claimed in claim 23, further comprising:

determining a degree of memory utilization within the plurality of egress queues; and

programming at least one of the first, second and third threshold as a function of said degree of memory utilization.

25. (Original) A method as claimed in claim 1, wherein the at least one output port of the processing fabric is a plurality of output ports and wherein each of the plurality of output ports is connected to a respective one of the plurality of egress queues.

26. (Original) A method as claimed in claim 1, wherein at least one of the at least one output port of the processing fabric is connected to a respective plurality of the plurality of egress queues.

27. (Original) A method as claimed in claim 1, wherein providing the discard probability associated with each egress queue to the control entity is executed on a programmable basis.

28. (Original) A method as claimed in claim 1, further comprising:

recording the discard probability associated with each egress queue at selected times;

detecting whether a change of at least a pre-determined magnitude has occurred in the discard probability associated with at least one of the egress queues;

wherein providing the discard probability associated with a particular one of the egress queues to the control entity is executed only if a change of at least the pre-determined magnitude has been detected in the discard probability associated with the particular egress queue.

29. (Original) A method as claimed in claim 1, further comprising:

recording the discard probability associated with each egress queue at selected times;

detecting whether a change of at least a pre-determined magnitude has occurred in the discard probability associated with at least one of the egress queues;

wherein providing the discard probability associated with a particular one of the egress queues to the control entity is executed either (i) if a change of at least the pre-determined magnitude has been detected in the discard probability associated with the particular egress queue; or (ii) after a pre-determined amount of time regardless of whether or not a change of at

least the pre-determined magnitude has been detected in the discard probability associated with the particular egress queue.

30. (Original) A method as claimed in claim 1, further comprising:

for each received packet, the control entity determining an egress queue for which the received packet is destined and either transmitting or not transmitting the received packet to the processing fabric on the basis of the discard probability associated with the egress queue for which the received packet is destined.

31. (Original) A method as claimed in claim 30, wherein either transmitting or not transmitting the received packet to the processing fabric on the basis of the discard probability associated with the egress queue for which the received packet is destined includes:

generating a random number for the received packet;

comparing the random number to the discard probability associated with the egress queue for which the received packet is destined; and

transmitting or not transmitting the received packet to the processing fabric on the basis of the comparison.

32. (Original) A method as claimed in claim 31, wherein not transmitting a received packet includes discarding the packet.

33. (Original) A method as claimed in claim 31, wherein not transmitting a received packet includes marking the packet as discardable.

34. (Original) A method as claimed in claim 31, wherein not transmitting a received packet includes storing the received packet in a memory location and marking the received packet as discardable, and wherein transmitting a received packet includes transmitting only those packets not marked as discardable.

35. (Original) A method as claimed in claim 34, wherein not transmitting a received packet further includes:

determining whether there exists a condition of reduced congestion at the egress queues; and

if there exists a condition of reduced congestion at the egress queues, determining whether the memory location needs to be used to store another packet and, if not, unmarking the packet as discardable.

36. (Original) A computer-readable storage medium containing program instructions for causing execution in a computing device of a method as defined in claim 1.

37. (Previously presented) A drop probability evaluation module for use in a device having (i) a processing fabric with at least one input port and at least one output port; (ii) a control entity connected to the at least one input port for regulating packet flow thereto; and (iii) a plurality of egress queues connected to the at least one output port for temporarily storing packets received therefrom, said drop probability evaluation module comprising:

means for obtaining bandwidth utilization information regarding packets received at the egress queues, wherein obtaining said bandwidth utilization information includes determining the amount of bandwidth consumed by packets received at each of said egress queues;

means for determining, from the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues, a discard probability associated with each egress queue; and

means for providing the discard probability associated with each egress queue to the control entity, for use by the control entity in selectively transmitting packets to the at least one input port of the processing fabric.

38. (Previously presented) A drop probability evaluation module for use in a device having (i) a processing fabric with at least one input port and at least one output port; (ii) a control entity connected to the at least one input port for regulating packet flow thereto; and (iii) a plurality of egress queues connected to the at least one output port for temporarily storing packets received therefrom, said drop probability evaluation module including:

an allocation processing entity, for determining an allocated traffic bandwidth for each of the egress queues; and

a probability processing entity in communication with the allocation processing entity, said probability processing entity being adapted to receive the allocated traffic bandwidth for each of the egress queues from the allocation processing entity and also adapted to receive an average number of received traffic bytes, per time unit, for each of the egress queues from an external entity, the probability processing entity being operable to:

compare the average number of received traffic bytes for each particular one of the egress queues to the allocated traffic bandwidth for the particular egress queue; and

set the discard probability for the particular egress queue to the sum of a time average of previous values of the discard probability for the particular egress queue and either a positive or a negative increment, depending on whether the average number of received traffic bytes for the particular egress queue is greater or less than the allocated traffic bandwidth for the particular egress queue.

39. (Original) A computer-readable storage medium containing a program element for execution by a computing device to implement the drop probability evaluation module of claim 38.

40. (Previously presented) An apparatus, comprising:

a processing fabric having at least one input port and at least one output port, the processing fabric being adapted to process packets received from the at least one input port and forward processed packets to the at least one output port;

a plurality of egress queues, each connected to a corresponding one of the at least one output port of the processing fabric, each egress queue being adapted to (i) temporarily store packets received from the corresponding output port of the processing fabric and (ii) determine bandwidth utilization information on the basis of the packets received at the egress queues, by determining the amount of bandwidth consumed by packets received at each of said egress queues;

a drop probability evaluation module connected to the egress queues, said drop probability evaluation entity being adapted to determine a discard probability associated with each of the egress queues on the basis of the bandwidth utilization information and the amount of bandwidth consumed by packets received at each of said egress queues; and

a packet acceptance unit connected to the at least one input port of the processing fabric and to the drop probability evaluation module, the packet acceptance entity being adapted to (i) receive packets destined for the at least one output port of the processing fabric; (ii) identify an egress queue associated with each received packet; and (iii) on the basis of the discard probability associated with the egress queue associated with each received packet, either transmit or not transmit said received packet to one of the at least one input port of the processing fabric.

41. (Original) Apparatus as claimed in claim 40, wherein the at least one output port is a plurality of output ports, the apparatus further comprising:

a plurality of output line cards, each output line card connected to a distinct subset of the plurality of output ports of the processing fabric;

wherein a portion of the drop probability evaluation module is provided on each of the output line cards;

wherein the portion of the drop probability evaluation module provided on a particular one of the output line cards is the portion of the drop probability evaluation module connected to those egress queues that are connected to the subset of the plurality of output ports of the processing fabric to which the particular output line card is connected.

42. (Original) Apparatus as claimed in claim 41, wherein the at least one input port is a plurality of input ports further comprising:

a plurality of input line cards, each input line card being connected to a distinct subset of the plurality of input ports of the processing fabric;

wherein a portion of the packet acceptance unit is provided on each of the input line cards.

43. (Original) Apparatus as defined in claim 40, wherein the processing fabric is a switch fabric.

44. (Previously presented) A method as defined in claim 1, wherein each packet has a corresponding priority selected from a group of priorities, said method comprising:

determining, from the bandwidth utilization information, a discard probability associated each of the priorities; and

providing the discard probability associated with each egress queue and priority to the control entity, for use by the control entity in selectively transmitting packets to the at least one input port of the processing fabric.

45. (Original) A method as claimed in claim 44, further comprising:

for each received packet, the control entity determining an egress queue for which the received packet is destined and the priority of the packet and either transmitting or not transmitting the received packet to the processing fabric on the basis of the discard probability associated with the

egress queue for which the received packet is destined and the priority of the packet.

46. (Previously presented) A method of regulating packet flow through a device having an ingress entity, an egress entity, a processing fabric between the ingress entity and the egress entity, and a control entity adapted to process packets prior to transmission thereof to the ingress entity, said method comprising:

obtaining congestion information regarding packets received at the egress entity, wherein obtaining said congestion information includes determining the amount of bandwidth consumed by packets arriving at the egress entity; and

providing the congestion information to the control entity, for use by the control entity in processing packets prior to transmission thereof to the ingress entity.

47. (Original) A method as defined in claim 46, further comprising:

for each packet received at the control entity, either transmitting or not transmitting the received packet to the ingress entity, on the basis of the congestion information.

48. (Original) A method as defined in claim 47, wherein not transmitting the received packet to the ingress entity includes discarding the received packet.

49. (Original) A method as defined in claim 47, wherein not transmitting the received packet to the ingress entity includes storing the packet in a memory location.

50. (Original) A method as defined in claim 47, wherein not transmitting the received packet to the ingress entity includes rerouting the packet along an alternate route.

51. (Original) A method as defined in claim 46, further comprising:

for each packet received at the control entity, either marking or not marking the received packet prior to transmission to the ingress entity, on the basis of the congestion information.

52. (Cancelled)

53. (Original) A method as defined in claim 46, wherein obtaining congestion information regarding packets received at the egress entity includes determining a discard probability.

54. (Original) A method as defined in claim 53, further including:

generating a quantity for each packet received at the control entity;

comparing the quantity to the discard probability; and

either transmitting or not transmitting the received packet to the ingress entity on the basis of the outcome of the comparing step.

55. (Original) A method as defined in claim 54, wherein the quantity is a random number.

56. (Cancelled)

57. (Original) A method as defined in claim 46, wherein the egress entity includes a plurality of egress queues and wherein the congestion information includes an occupancy of each of the egress queues.

58. (Original) A method as defined in claim 57, wherein the egress entity includes a plurality of egress queues and wherein the congestion information includes a variability in the occupancy of each of the egress queues.

IX. Evidence Appendix

There is no evidence submitted herewith.

X. Related Proceedings Appendix

There are no related proceedings at per paragraph c(1)(ii) indicated above.

CONCLUSION

It is respectfully submitted that all of claims 1-51, 53-55 and 57-58 are in condition for allowance as they currently stand. Reconsideration of the rejections and objections is requested. Allowance of claims 1-51, 53-55 and 57-58 at an early date is solicited.

Respectfully submitted,

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